

3.1 Air Quality (Greenhouse Gases)

3.1.1 Existing Conditions

This section discusses greenhouse gas emissions from combustion of fuels and release of gas from potential leak points. No other air emissions are discussed within the limited scope of this SEIS.

Currently, there are no international, national, state, or local regulations that set numerical limits on greenhouse gas emissions. However, the Washington State rule relating to siting energy facilities (WAC 463-42-225, Proposal – emission control) requires the applicant to demonstrate that highest and best practicable treatment for control of emissions is used for a number of air pollutants, including CO₂. The rule does not specify how “highest and best practicable treatment” for CO₂ emissions is determined. SE2’s original ASC (1999) acknowledged that greenhouse gas emissions from the S2GF could pose an environmental concern. SE2 originally proposed a greenhouse gas mitigation plan that specified a series of annual payments totaling \$1 million for qualified third parties to fund regional and worldwide offset projects (Sumas Energy 2, Inc. 1999).

As part of its previous Findings of Fact, Conclusions of Law, and Order Recommending Denial of Site Certification (February 2001), EFSEC concluded that SE2’s originally proposed greenhouse gas mitigation plan failed to satisfy EFSEC’s obligations to avoid or mitigate adverse environmental impacts. In the Second Revised ASC (2001), SE2 revised its proposal for greenhouse gas mitigation to include the measures described below.

3.1.1.1 Regulatory Framework

There are currently no regulations on greenhouse gas emissions specified by international, federal, state, or local rules. The U.S. signed the internationally negotiated Kyoto Protocol in 1999, agreeing with the other signatory nations on the overall objectives of the Protocol and agreeing with its specified emission reductions. The Protocol would commit the developed nations of the world to reduce their greenhouse gas emissions by an average of about 30 to 40% by the year 2012.

Although all of the signatory nations agreed to the overall objectives of the Protocol, this does not mean that it has become international law. The Protocol would be enacted and would obtain international law status only if at least 55 nations responsible for at least 55% of global greenhouse gas emissions ratify individual treaties to specify emission tracking and international enforcement. President Bush has indicated he will not sign a ratification treaty for the Kyoto Protocol. However, the Protocol would become international law even without U.S. ratification if a sufficient number of the remaining nations ratified their own treaties.

3.1.1.2 Recent Global Warming Research

The issue of how emissions from human activities might affect global climate has been the subject of extensive international research over the past several decades. There is now a broad consensus among atmospheric scientists that anthropogenic emissions are causing a rise in global temperatures, although there is still uncertainty about the magnitude of future impacts and the best approach to mitigate the impacts. Two sets of key research documents have recently been published.

The United Nations Intergovernmental Panel on Climate Change (IPCC) published its most recent set of 5-year progress reports summarizing worldwide research on global warming (IPCC 2001a, IPCC 2001b). These reports indicated that some level of global warming related to human activity is likely to occur and that there is a significant possibility of severe environmental impacts.

President Bush requested the National Academy of Sciences to provide a brief comprehensive review of the IPCC reports (National Academy of Sciences 2001). The review panel included atmospheric scientists with a range of opinions on future global warming. The National Academy of Sciences review was written in lay terms and focused on addressing several fundamental issues. The panel concurred with most of the findings by the IPCC.

3.1.1.3 Comparison of Local Versus Worldwide Greenhouse Gas Emissions

Table 3.1-1 lists greenhouse gas emissions worldwide and from the United States, Washington State, and the proposed S2GF project. The table also lists the total estimated future greenhouse gas emissions from the new gas-fired power plants forecasted to be built in the Pacific Northwest (BPA 2001a). There are many air pollutants that comprise “greenhouse gases,” each of which exhibits a different chemical tendency to affect global warming. The two most common greenhouse gases associated with gas-fired power plants are carbon dioxide (CO₂) emitted from the exhaust stacks and methane (CH₄) emitted as fugitive leaks of natural gas along the pipeline system. Emissions of various greenhouse gas chemicals are commonly standardized as “carbon equivalents.” The emission rates listed in Table 3.1-1 are standardized as million metric tons of carbon equivalents (MMTCE) per year. For comparison, 1 million tons of CO₂ is equal to 0.25 MMTCE. As listed in the table, most of the greenhouse gas emissions are in the form of CO₂, while a smaller fraction of the emissions are in the form of other gases such as methane or nitrous oxide.

Table 3.1-1. Comparison of Worldwide vs. Local Greenhouse Gas Emissions

Item	Annual Greenhouse Gas Emissions (MMTCE per year)		
	CO ₂	Compounds Other than CO ₂	Total
Worldwide emissions (including. U.S.) (1998)	5,660	2,430	8,090
United States emissions (1998)	1,494	340	1,834
Washington State emissions (1995)	21	4	25
Anticipated future gas-fired power plants in Washington and Oregon (15 plants; 7,000 MW)	5.4	0.6	6.0
Proposed S2GF emissions	0.595	0.076	0.67
MMTCE – million metric tons of carbon equivalent Sources: IPCC 2001; EPA 2000; CTED 1999; BPA 2001a.			

3.1.2 Environmental Impacts of Proposed Project

Natural gas-fired combined-cycle turbine power plants are recognized to be the most efficient form of fossil-fueled power generation (for generating facilities with capacity similar to the S2GF), in terms of both energy efficiency and greenhouse gas emissions. Table 3.1-2 compares the estimated greenhouse gas emission factors for the S2GF and other types of fossil-fueled plants. The emission factors are expressed as pounds of CO₂ per kilowatt of electricity produced by the plant. As listed in the table, combined-cycle gas turbines fired by natural gas inherently emit less greenhouse gas than do other types of plants.

The S2GF project would emit an estimated 2.4 million tons per year of CO₂ from its exhaust stacks. Fugitive leaks of natural gas from the pipeline system serving the power plant are estimated to emit CH₄ equivalent to 12% of the plant's stack emissions of greenhouse gas (U.S. Department of Energy 2000). The total annual greenhouse gas emissions associated with the S2GF project (stack emissions plus fugitive leaks from the upstream pipeline) would be 0.67 MMTCE. Based on the data listed in Table 3.1-1, these total emissions would be 2.7% of the amount of greenhouse gas presently emitted from all sources in Washington State and 11% of the amount anticipated to be issued from all proposed future power plants in the Northwest. The greenhouse gas emissions from the S2GF would be a small fraction (0.15%) of the United States emissions, so the actual effect on global warming caused solely by emissions from the S2GF is unknown.

Table 3.1-2. CO₂ Emission Factors for Electrical Generating Stations

Generating Station Fuel Type	CO ₂ Emission Factor (lb CO ₂ per kWh)
Natural gas fuel, combined-cycle combustion turbine	0.873
Natural gas fuel, conventional gas-fired boiler	1.2
Fuel oil, conventional oil-fired boiler	1.9
Coal, conventional coal-fired boiler	2.1
Other solid fuel generating stations	2.95
Nationwide average for electric utility generating stations (1998)	1.35
Source: U.S. Department of Energy 1999.	

3.1.3 Mitigation Measures

Global warming caused by greenhouse gas emissions is a worldwide problem caused by worldwide emissions. The magnitude of the temperature increase in Washington and British Columbia caused by the S2GF emissions would be the same regardless if the plant were located in Sumas; Seattle; Vancouver, B.C.; or anywhere else on the planet. Similarly, greenhouse gas mitigation would benefit Sumas and British Columbia regardless of where the mitigation measures were implemented. The greenhouse gas mitigation proposed by most power plant developers involves funding of worldwide greenhouse elimination programs. Greenhouse gas reductions anywhere on earth would benefit residents near the power plant as much as greenhouse gas reduction in the immediate vicinity of the plant.

3.1.3.1 Proposed (Revised) SE2 Greenhouse Gas Mitigation Plan

SE2 proposes to offset a portion of its greenhouse gas emissions from the S2GF facility according to a “monetary path” offset payment program. SE2 proposes to pay an emission fee on all CO₂ emissions in excess of thresholds established by the Oregon Energy Facility Siting Council, as specified by the Oregon Administrative Rules (OAR) Chapter 345, Part 24. The S2GF is not subject to Oregon regulations, but SE2 proposes to enter into binding agreements with EFSEC to make the required payments to the Climate Trust for all emissions exceeding the Oregon standard.

The Oregon rule establishes a CO₂ emission standard of 0.675 pound of CO₂ per kilowatt-hour (lb/kWh) of electricity produced for base-load natural gas-fired electric utility plants. The emission standard is approximately 17% less than the most efficient plant operating in the United States. Thus, the Oregon rule does not prohibit greenhouse gas emissions, but it imposes monetary incentives to encourage developers to install the most efficient power plants. Under the Oregon regulation all “excess emissions” (CO₂ emissions from a proposed new power plant that exceed the CO₂ emission standard) must be offset by a combination of the following methods:

- The proposed new plant can use cogeneration to reduce its overall CO₂ emissions.
- The proposed plant can develop its own CO₂ offsets, and then provide demonstrations to certify the actual CO₂ reductions.
- The proposed plant can enter into the “monetary path” offset agreement to provide funding to third parties for purposes of developing off-site greenhouse elimination programs.

SE2 proposes to participate in a “monetary path” program, but its proposal differs considerably from the Oregon rule. The provisions under SE2’s proposed program are as follows:

- SE2 would pay emission fees to the Climate Trust, which would use the funds to finance regional programs to offset CO₂ emissions. SE2 would not provide any additional funding for program administration. This payment method differs significantly from the Oregon rule, which required the power plant to provide additional funding to cover administration and monitoring.
- SE2 would pay emission fees for all CO₂ emissions exceeding the Oregon emission standard (0.675 lb/kWh for base-load operation and 0.70 lb/kWh for periods when the plant augments its power output using duct burners). This provision is similar to the Oregon rule.
- The amount of excess emissions subject to emission fees would be based on the actual CO₂ emission rates that are measured by one-time stack tests conducted within 1 year after facility startup. This provision is similar to the Oregon rule.
- SE2 would make up-front payments over the first 5 years of operation sufficient to cover an assumed 30 years of operation at 100% load factor. There would be no provision to provide additional funding if the plant operated for more than 30 years, and there would be no provision to reimburse SE2 if the plant operated for less than 30 years or if it operated at less than 100% load factor. This payment schedule differs from the Oregon rule, which requires a one-time payment to cover the assumed 30 years of operation.

The most significant deviation from the Oregon program is SE2’s proposed emission fee. SE2 proposes to pay \$0.57 per ton of excess CO₂ emissions, with no payment of additional fees to cover program administration. SE2’s proposed fee was the amount that was required by the Oregon rule as of early 2001, when SE2 developed its proposal. Oregon has since increased the required fee for new power plants in that state to \$0.86 plus 5% additional fees to cover program administration, but SE2 has stipulated that its proposed fee remain at \$0.57. As described below, the state of Oregon and other organizations managing off-site greenhouse gas elimination programs recognize the current actual unit cost is considerably higher than \$0.57 per ton of eliminated CO₂.

3.1.3.2 Environmental Benefits of Proposed Greenhouse Gas Mitigation

Off-site greenhouse gas elimination projects currently being funded in the Northwest offer benefits for both reduction of global warming and other environmental concerns. Greenhouse gas offset projects are already being funded by the Oregon Climate Trust and Seattle City Light. Examples of some of the projects already funded are described below:

- Funding the Bonneville Environmental Foundation to retire fossil-fuel electrical generating equipment, and replacing it with the electricity from the wind farm in Condon, Oregon.
- Funding an innovative landfill gas pretreatment facility at the Roosevelt Landfill in Washington. The system will separate CO₂ from the landfill gas before the gas is used for fuel in an on-site electrical generator. The recovered CO₂ will be sold to a local processing plant.
- Funding development of a web-based computer system to facilitate new carpools in the Portland area.

The quantitative evaluation of potential benefits related to SE2's proposed greenhouse gas offset plan includes consideration of the following issues because it is based partly on the Oregon plan:

- The estimated CO₂ emissions from the S2GF and how they compare to Oregon's CO₂ emission standard
- The amount of money SE2 would provide to the Climate Trust based on the proposed \$0.57 per ton emission fee
- The fraction of the S2GF's CO₂ emissions that actually could be eliminated using the fee payments to the Climate Trust.

These data are presented in Table 3.1-3 and are addressed in the following sections.

Table 3.1-3. Estimated CO₂ Offset Funds to the Climate Trust

Item	Value
CO₂ Offsets Exceeding Oregon Emission Standard	
Estimated CO ₂ emission factor for S2GF	0.837 lb CO ₂ /kWh
Potential annual electricity production at 100% capacity	5.78 x 10 ⁹ kWh/yr
Potential annual CO ₂ emissions at 100% capacity (0.837 lb/kWh * 5.78 x 10 ⁹ kWh/yr / 2,000 lb/ton)	2.42 million tons CO ₂ /yr
Oregon CO ₂ emission standard for base-load plants	0.675 lb/kWh
S2GF CO ₂ emissions satisfying Oregon standard at 100% capacity (0.675 lb/kWh * 5.78 x 10 ⁹ kWh/yr / 2,000 lb/ton)	1.95 million tons CO ₂ /yr
Excess CO ₂ emissions subject to Oregon emission fee = difference between potential CO ₂ emissions and Oregon standard (2.42 million tons/yr – 1.95 million tons/yr)	470,000 tons CO ₂ /yr
Estimated Emission Fee Payment to the Climate Trust	
Unit emission fee proposed by SE2	\$0.57/ton CO ₂
Estimated 30-year payment to the Climate Trust (470,000 tons/yr * \$0.57/ton * 30 yr)	\$8.04 million
Estimated cost for fund administration and project monitoring (10% x \$8.04 million)	\$804,000
Estimated funds available for greenhouse elimination projects (\$8.04 million - \$804,000)	\$7.24 million
Actual CO₂ Elimination Achievable by Fee Payment	
Funds available for greenhouse gas elimination projects	\$7.24 million
Assumed actual unit cost for CO ₂ elimination	\$2/ton to \$4/ton
Estimated amount of CO ₂ actually eliminated (\$7.24 million / \$2/ton) to (\$7.24 million / \$4/ton)	1.8 million to 3.6 million tons of CO ₂
Fraction of S2GF CO ₂ emissions actually eliminated (1.8 million tons / [2.42 million tons/yr * 30 yr]) to (3.6 million tons / [2.42 million tons/yr * 30 yr])	2.5% to 5%

CO₂ Emission Rate

SE2 reports its estimated CO₂ emission rate would be 0.837 lb CO₂ per kWh of electricity production, with a full-load annual electricity production of 5.78×10^9 kWh per year. Based on those assumed full-load conditions, the potential maximum CO₂ emissions from the S2GF would be 2.42 million tons per year. SE2 previously reported that its anticipated actual load factors over 30 years of plant operation would be 85% capacity and 97% load (Sumas Energy 2, Inc. 1999), so actual CO₂ emissions would be lower than this.

Emissions Exceeding Oregon Emission Standard

SE2 would pay emission fees on an estimated 470,000 tons per year of excess CO₂, based on full-load conditions. This estimate of the excess emissions is based on SE2's estimate of the plant's CO₂ emission rate. The actual emission fee basis would be determined from stack tests conducted upon startup.

Payment to the Climate Trust

Based on an emission fee of \$0.57 per ton, SE2 would pay five equal annual installments totaling \$8.04 million. Not all of the funds paid by SE2 would be available for greenhouse gas elimination because some of the funds would have to be used for project administration and monitoring. If it were assumed that program administration costs are 10% of the total, then an estimated \$7.24 million would be available for greenhouse gas elimination projects.

Actual Cost of Greenhouse Gas Elimination

SE2's proposed emission fee of \$0.57 per ton of excess CO₂ is less than the actual unit cost to eliminate a ton of CO₂ incurred by organizations already operating greenhouse gas elimination programs. For example, the Oregon Climate Trust's actual elimination costs based on its first round of offset projects averaged \$1.50 per ton (Nelson pers. comm.), and its recent testimony to the Oregon Energy Facility Siting Council documented a range of unit costs from \$0.60 to \$12.00 (Burnett 2001). Seattle City Light is currently working with the Oregon Climate Trust to find CO₂ elimination projects to offset its purchase of electricity from the new gas-fired power plant near Klamath Falls, Oregon. City Light's actual negotiated costs for its most recent round of contracts averaged \$2 per ton of CO₂, and it has allocated funds to cover future costs at \$5 per ton of CO₂ over the next 5 years (Howell pers. comm.). City Light has estimated that the actual costs for the upcoming round of contracts will be roughly \$4 per ton of CO₂. Based on these reported actual unit costs, the analysis for this SEIS assumes a range of actual unit costs of \$2 to \$4 per ton of eliminated CO₂.

S2GF Emissions Offset

There is uncertainty about what the actual unit cost for off-site greenhouse gas elimination projects will be during the 30-year life of the S2GF. Under current conditions, the analysis presented in this SEIS is based on a range of elimination unit costs of \$2 to \$4 per ton of CO₂. Therefore, SE2's fee payment to the Climate Trust would pay for eliminating between 1.8 million to 3.6 million tons of CO₂ over a 30-year period. That elimination is equivalent to a range of 2.5% to 5% of the total CO₂ emissions from the facility.

As costs of CO₂ elimination grow, with SE2 contributing a fixed fee, the fraction of CO₂ eliminated compared to that emitted would be reduced to less than 6% and would continue to decrease as costs rise.

The fraction of greenhouse gas elimination estimated based on SE2's proposal (2.5% to 5%) is less than the targets established for other ongoing greenhouse gas offset programs in the Northwest. The greenhouse gas elimination targets for other existing programs are described below:

- The state of Oregon's target is a 17% reduction compared to the most efficient power plant operating in the United States.
- Seattle City Light's greenhouse gas program cites a target of 100% elimination of net future increases of greenhouse gas emissions from all new fossil fuel generating stations added to the city's generating mix (Seattle City Light 2001).
- BC Hydro plans to contract with third-party organizations to procure off-site greenhouse gas projects to offset 50% of the increase in greenhouse gas emissions from two new natural gas-fired electrical generating stations on Vancouver Island, up through the year 2010 (BC Hydro 2001). The year 2010 was specified in the Kyoto Protocol as the date upon which signatory nations must reduce their greenhouse gas emissions. Presumably, new emission reduction programs enacted in response to the Kyoto Protocol (or similar rules) would take effect after BC Hydro's voluntary offset program expired in 2010.

3.1.3.3 Mitigation Offset Goal

If there is a goal to meet a certain percentage of offset, EFSEC could require that the applicant commit to that goal and commit to an annual contribution which would cover the actual costs of such offsets.

3.1.3.4 Potential Detrimental Effect of Proposed Greenhouse Gas Mitigation

Currently there are no international, national, state, or local regulations that set numerical limits on greenhouse gas emissions. EFSEC's jurisdiction over fossil fuel-fired plants extends to facilities greater than 250 MW sited between 1970 and 2001, and greater than 350 MW sited after May 2001. Therefore, EFSEC has no jurisdiction over certain existing or proposed power plants and it is unable to impose greenhouse gas mitigation on all fossil fuel-fired electrical generating stations already operating in the state. These existing plants not under EFSEC's jurisdiction include coal-fired units, single-cycle turbines, combined-cycle turbines, oil-fired units, and wood waste burners.

BPA has prepared cumulative air quality assessments to evaluate the potential impacts caused by 15 proposed power plants that are considered by BPA to have a relatively high likelihood of being constructed (BPA 2001b). BPA's list of assumed future power plants includes the following facilities that would not be subject to Washington EFSEC or Oregon Energy Facility Siting Council certification, and therefore would be unlikely to implement greenhouse gas offsets:

- Fredonia Facility, 108-MW natural gas combined-cycle combustion turbine (CCCT) with significant oil firing
- Rathdrum Power, 270-MW natural gas CCCT
- Fredrickson Power, 249-MW natural gas CCCT
- Coyote Springs 2, 280-MW natural gas CCCT
- Goldendale Energy Project, 248-MW natural gas CCCT
- Longview Energy, 290-MW natural gas CCCT with significant oil firing
- Goldendale (the Cliffs), 225-MW natural gas CCCT
- Big Hanaford Project, 267-MW natural gas CCCT
- Mint Farm Generation, 319-MW natural gas CCCT

Some of these proposed power plants and many existing power plants would have higher CO₂ emissions than the S2GF plant.

Requiring greenhouse gas emission fees only on combined-cycle proposals under EFSEC jurisdiction could impose a slight financial penalty for the newer, more efficient plants compared to the older, less efficient plants already operating. If the greenhouse gas fees were applied as an up-front capital cost (as in the case of SE2's proposal for the S2GF plant), it is conceivable that the cost increase could discourage investors and thus delay the construction of the new power plants, thereby favoring operation of the older plants.

Alternatively, if the greenhouse gas fees were applied as a variable “emission tax” based on the plant’s actual emissions, then it could incrementally increase the dispatch cost of the new power plants, thus favoring increased hours of operation of existing power plants with higher emissions. It is conceivable that either scenario could result in higher greenhouse gas emissions within the region.